NOTES ON THE ECOLOGY, ZOOGEOGRAPHY, AND COLORATION OF THE GOBIESOCID CLINGFISHES, *LEPADICHTHYS CARITUS* BRIGGS AND *DIADEMICHTHYS LINEATUS* (SAUVAGE)

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(Communicated by Gilbert P. Whitley)

[Accepted for publication 18th April 1973]

Synopsis

The commensal association between *Lepadichthys caritus* Briggs and comasterid crinoids is reported and notes are included on the live coloration. The species was originally described from a single specimen collected at the Seychelles Islands, Indian Ocean. It is recorded in the present paper from Palau, New Guinea, and the Great Barrier Reef. Observations are also included on the ecology of *Diademichthys lineatus*, a gobiesocid which sometimes associates with sea urchins of the genus *Diadema*.

Briggs (1969) described *Lepadichthys caritus* from three specimens, 15·5 to 22·8 mm standard length, collected at the Seychelles Islands during the International Indian Ocean Expedition programme in 1964. The description did not include information on habitat or live coloration.

While diving along the edge of Malakal Channel in the Palau Group, western Caroline Islands, in February, 1972, the junior author sighted a small blackish fish hovering among the arms of a comasterid crinoid. Later we collected seven of these fish (6·9 to 23·1 mm SL), which agree with Briggs' description of *L. caritus*, by gathering up approximately 20 crinoids, depositing them in a bucket of sea water, adding a small amount of quinaldine (a fish anaesthetic), and shaking out the fishes. The crinoids were taken from relatively shallow water (approximately 2 to 4 m) along the edge of Malakal Channel. They were generally attached to coral outcrops which projected several metres from the bottom. Currents of 2 to 3 knots, which are associated with the changing tides, are characteristic of the area.

Briggs gave the alcohol coloration of his specimens as " perfectly pale and translucent with no evidence of pigmentation ". The live colours of the specimens we collected in Palau were as follows : head and body jet black except for three yellow longitudinal lines, about pupil width or less ; one on dorsal midline, from snout to vicinity of dorsal fin origin ; other two on each side of body, from snout, through upper part of eye, along upper portion of side to caudal fin ; mid-portion of caudal fin dusky blackish ; remainder of fin translucent with yellow-orange tinge ; dorsal, anal, and pectoral fins likewise translucent with yellow-orange tinge.

The clingfish from Palau discussed by Bayer and Rofen (1957) is most certainly the same species. Briggs (personal communication) stated that a formal description of the fish was never published, but a drawing of the specimen sent by Rofen agreed with the clingfish which was described later by Briggs as *L. caritus*. The live coloration reported by Bayer and Rofen is similar to our Palau material except there is no mention of a yellow stripe on the dorsal midline.

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The general colour pattern of *L. caritus* is similar to that of *L. lineatus* which Briggs (1966) described from the Red Sea. However, *lineatus* has two additional pairs of lines on the lower half of the body on a background of reddish-brown. This species was observed by Fishelson (in Briggs, 1966) as a commensal with the Red Sea crinoid, *Capillaster multiradiata*. Briggs (1969) remarked that *L. lineatus* is most closely related to *L. caritus*, a conclusion which our observations substantiate.

During May, 1972, the junior author observed and collected two individuals of *L. caritus* (17·2 and 27·2 mm SL) at a depth of 10 m living commensally with a bright yellow crinoid at Madang, New Guinea. The coloration of these fish was yellow, which served as an effective camouflage. The Palau specimens also blended in effectively with their crinoid host, which was largely blackish with yellow tips on the pinnules. Fish from both localities assumed a reddish coloration (except for the yellow lines) immediately after immersion in formalin while still alive. The Palau fish underwent a similar change while under the influence of quinaldine, but the normal coloration was restored as soon as the effects of the drug had vanished. After several months of preservation in alcohol, the Madang specimens agree with the colour description given by Briggs.

Two additional specimens (7·5 and 7·8 mm SL) were collected in November, 1972, by the senior author in 14 m depth at Opal Reef, Great Barrier Reef, off Port Douglas, Queensland. The fish were associated with a himerometrid crinoid (*Himerometra robustipinna* Carpenter) and were identical in live coloration to the Palau specimens.

The specimens from Palau, New Guinea, and the Great Barrier Reef, which have been deposited at the Australian Museum in Sydney, represent a substantial increase in the known geographic range of *L. caritus*, which was previously recorded only from the Seychelles, Indian Ocean. A similar increase in geographic range was recently reported for *L. bolini*, which, prior to Briggs' (1969) Seychelles record, was known on the basis of a single specimen collected at the New Hebrides. It is likely that several of the nine known species of *Lepadichthys* will ultimately prove to have relatively widespread Indo-West Pacific distributions, but because of their small size and inconspicuous habits they remain largely uncollected.

At Madang we observed about a dozen individuals of *Diademichthys lineatus* (Sauvage). Pfaff (1942) reported that this small clingfish associated with sea urchins of the genus *Diadema*. However, only one of the fish we sighted was with *Diadema*, in spite of the abundance of the latter. The fish were usually observed hovering horizontally over small patches of coral of the genus *Acropora*. This unusual, long-snouted clingfish was generally jet black with translucent fins and several narrow white lines positioned as follows : mid-dorsal line from tip of snout to about dorsal fin origin ; pair of lines on side from snout, passing through upper portion of eye and continuing along middle of sides to region slightly ahead of caudal base ; mid-ventral line from pelvic disc to origin of anal fin. *D. lineatus* is widespread in the Indo-West Pacific region.

The gobiesocids, *Lepadichthys caritus* and *L. lineatus* are the only fishes which are known to form a commensal association with crinoids, although Bruce (1971) reported a number of pontoniid shrimps from crinoid hosts. The crinoids offer concealment from predators which is further enhanced by the camouflage coloration of the fishes. Perhaps the fishes also take advantage of the favourable position of the crinoids (i.e., high above the bottom, exposed to currents) in procuring planktonic food which could be eaten directly from the current or after it became entangled in the " sticky " crinoid appendages. The transparent sea whip goby *Cottogobius yongei* Davis and Cohen (1969) forms a similar association with the antipatharian, *Cirrhipathes*.

Diademichthys lineatus is a more mobile clingfish and may range several metres away from its host coral head or *Diadema*, which is used primarily as a

sanctuary when danger threatens, and possibly as a nocturnal retreat. Allen (1972) discussed similar, although closer, relationships between apogonid fishes and the crown-of-thorns starfish, *Acanthaster*, and urchins of the genus *Diadema*. Whitley (1950) reported the presence of sea urchin tube feet among the stomach contents of *Diademichthys*. Hence, these clingfish may sometimes obtain nourishment from their hosts.

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